

Higher Order Thinking Skills

Primary 5

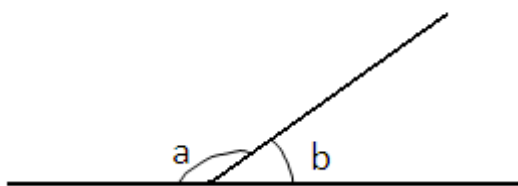
Lesson 8:
Geometry

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LESSON 8 Geometry (I)**Properties of Angles**

1. Angle on a straight line:

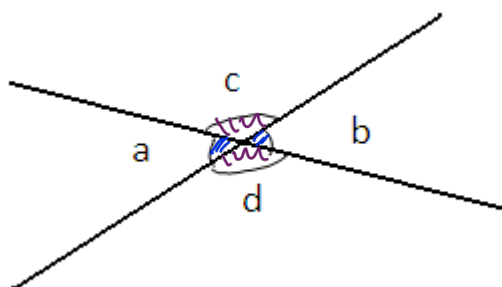
$$\angle a + \angle b = 180^\circ$$



2. Vertically opposite angles:

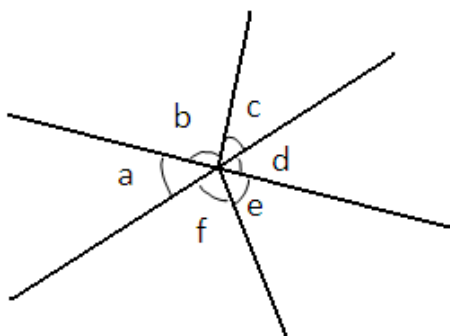
$$\angle a = \angle b$$

$$\angle c = \angle d$$



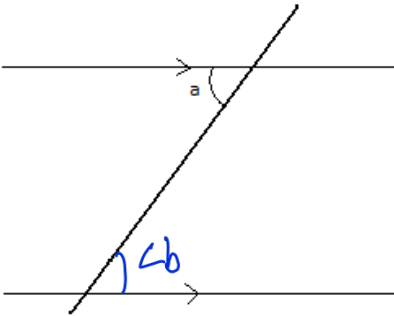
3. Angles at a point:

$$\angle a + \angle b + \angle c + \angle d + \angle e + \angle f = 360^\circ$$



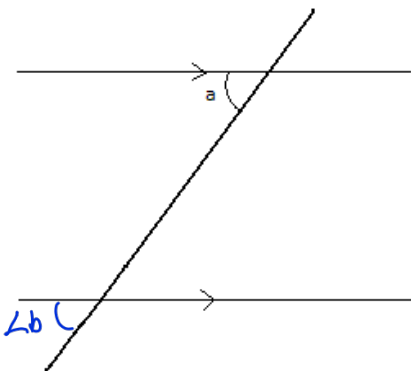
4. Alternate Angles

$$\angle a = \angle b$$



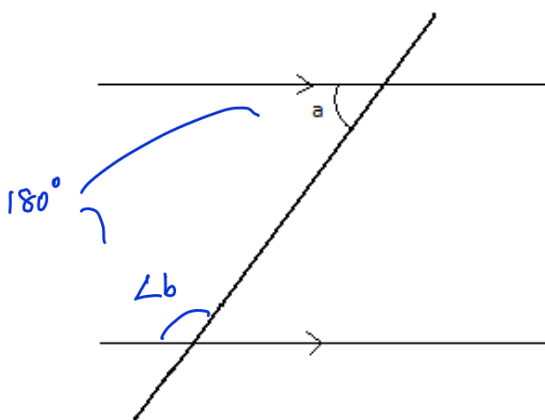
5. Corresponding Angles

$$\angle a = \angle b$$



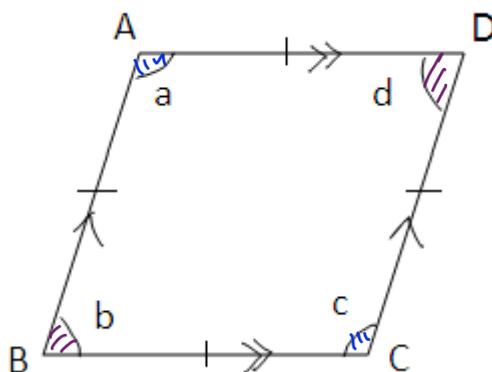
6. Interior Angles between parallel lines

$$\angle a + \angle b = 180^\circ$$



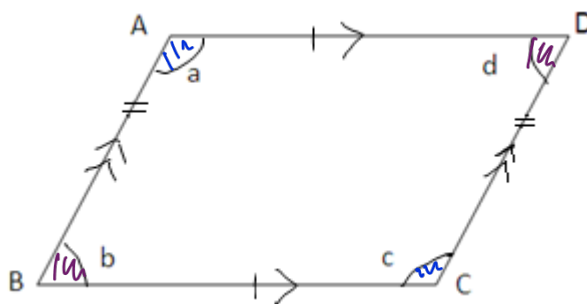
7. RHOMBUS:

Opposite sides are parallel
 $AB = BC = CD = AD$
 $\angle a = \angle c$
 $\angle b = \angle d$
 $\angle a + \angle d = 180^\circ$
 $\angle b + \angle c = 180^\circ$
 $\angle a + \angle b = 180^\circ$
 $\angle c + \angle d = 180^\circ$
 ABD, BCD, ADC and ABC are isosceles Δ s.



8. PARALLELOGRAM:

Opposite sides are parallel
 $AB = CD$
 $AD = BC$
 $\angle a = \angle c$
 $\angle b = \angle d$
 $\angle a + \angle b = 180^\circ$
 $\angle c + \angle d = 180^\circ$
 $\angle b + \angle c = 180^\circ$
 $\angle a + \angle d = 180^\circ$

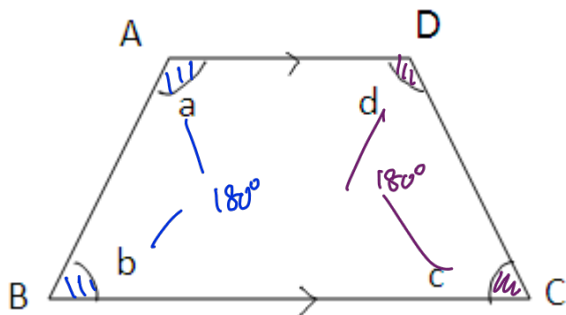


9. TRAPEZIUM:

One pair of parallel sides; $AD \parallel BC$

$$\angle a + \angle b = 180^\circ$$

$$\angle c + \angle d =$$



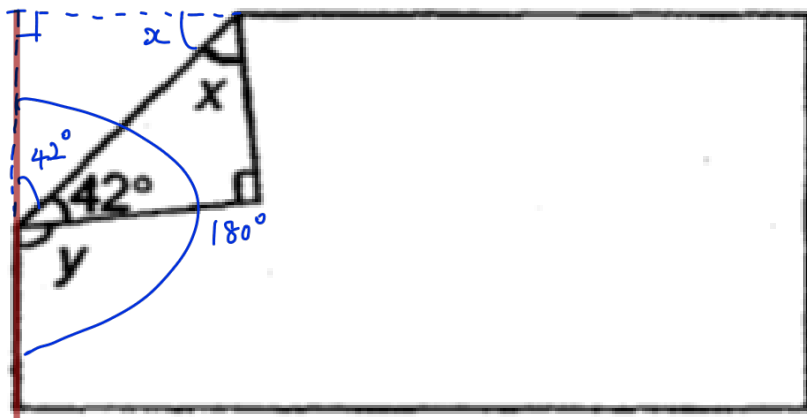
GUIDED EXAMPLE 1

A rectangular piece of paper is folded as shown.

Find:

a) $\sphericalangle x$

b) $\sphericalangle y$



(MGS P5)

$$\begin{aligned} \text{a) } \sphericalangle x &= 180^\circ - 42^\circ - 90^\circ \\ &= 48^\circ \end{aligned}$$

$$\begin{aligned} \text{b) } \sphericalangle y &= 180^\circ - 42^\circ - 42^\circ \\ &= 96^\circ \end{aligned}$$

Ans : a) 48°
b) 96°

GUIDED EXAMPLE 2

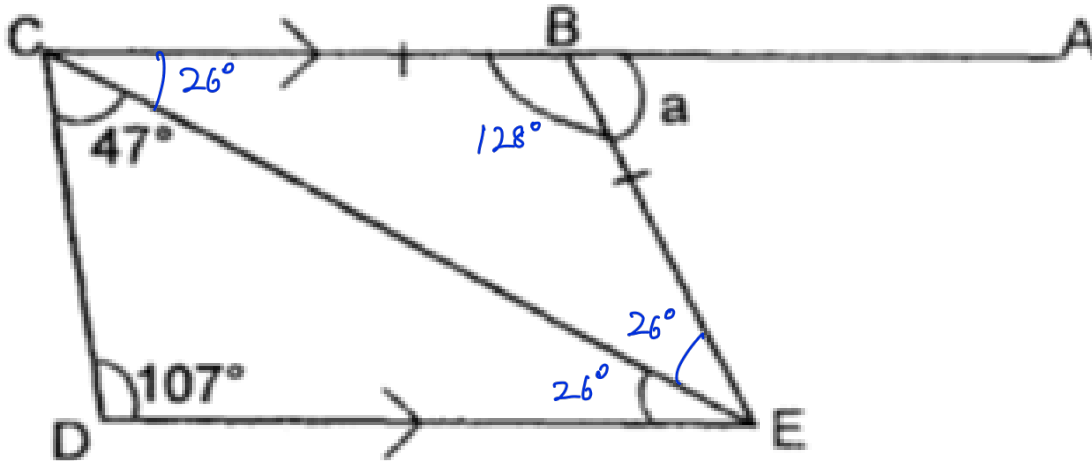
In the figure below, ABC is a straight line.

CBE is an isosceles triangle.

CB and DE are parallel lines.

Find $\angle a$.

(RGPS P5)



$$\begin{aligned} \angle CED &= 180^\circ - 47^\circ - 107^\circ \\ &= 26^\circ \end{aligned}$$

$$= \angle ECB \quad (\text{alt. } \angle s)$$

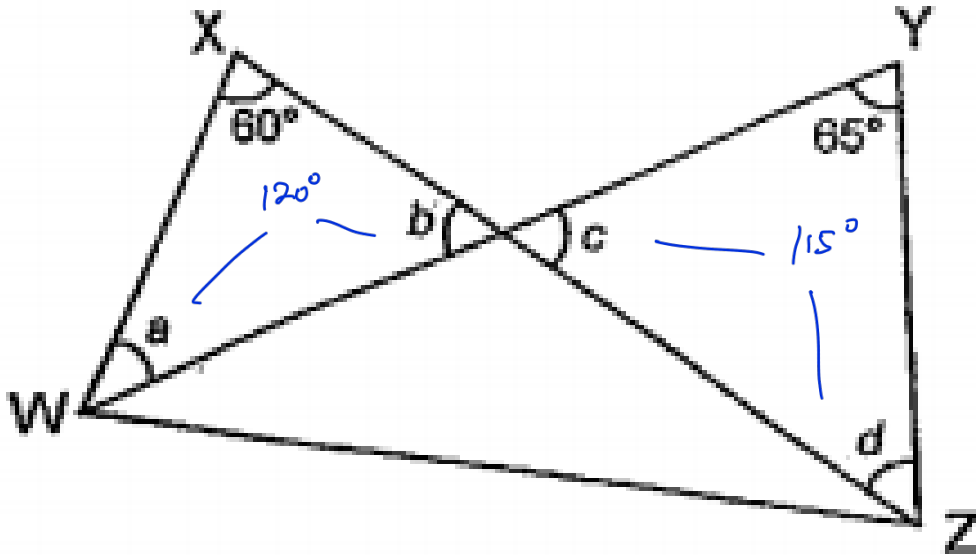
$$\begin{aligned} \angle CBE &= 180^\circ - 26^\circ - 26^\circ \\ &= 128^\circ \end{aligned}$$

$$\begin{aligned} \angle a &= 180^\circ - 128^\circ \\ &= 52^\circ \end{aligned}$$

Ans : 52°

GUIDED EXAMPLE 3

The diagram below, not drawn to scale, is made up of 2 overlapping triangles WXZ and WYZ.
Find the sum of $\angle a$, $\angle b$, $\angle c$ and $\angle d$.



(Nan Hua P5 CA2)

Not possible to find individual angles \rightarrow use grouping

$$\begin{aligned}\angle a + \angle b &= 180^\circ - 60^\circ \\ &= 120^\circ\end{aligned}$$

$$\begin{aligned}\angle c + \angle d &= 180^\circ - 65^\circ \\ &= 115^\circ\end{aligned}$$

$$\begin{aligned}\text{Required sum} &= 120^\circ + 115^\circ \\ &= 235^\circ\end{aligned}$$

$$\text{Ans : } \underline{235^\circ}$$

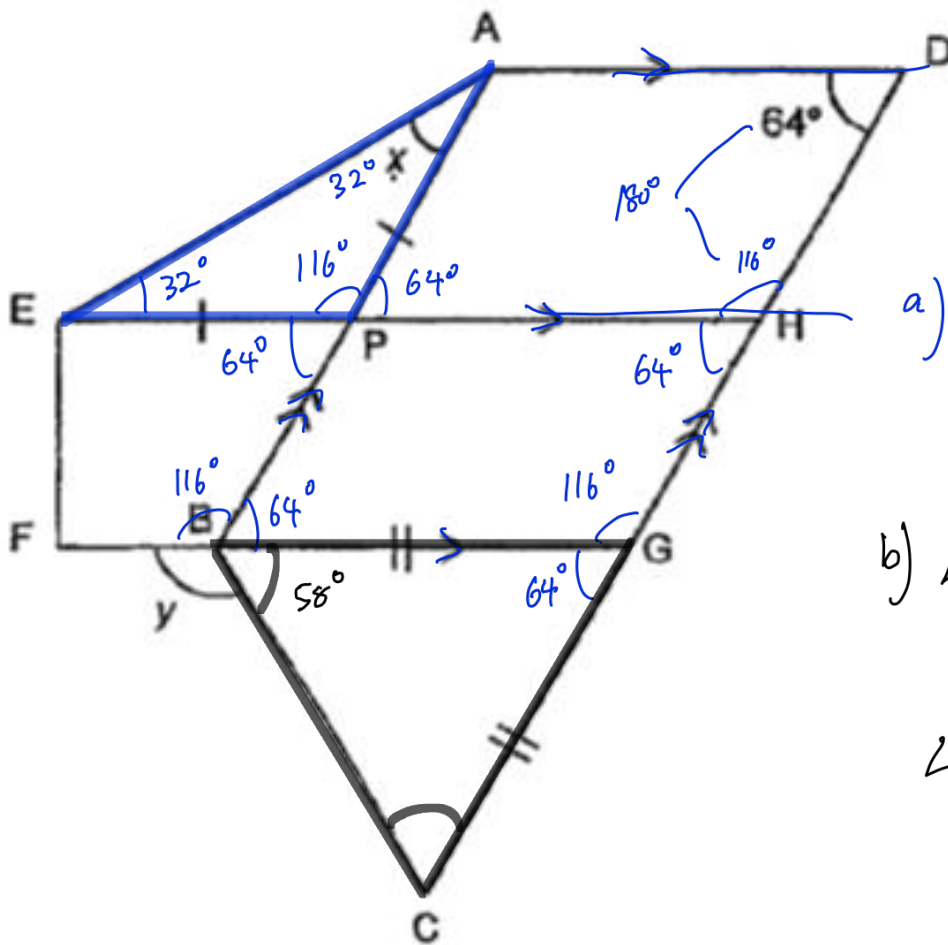
GUIDED EXAMPLE 4

In the figure below, ADHE, ADCB and EHGf are trapeziums.

[APE and BGC are isosceles triangles.]

$\angle ADH = 64^\circ$.

- a) Find $\angle x$.
- b) Find $\angle y$.



$$\begin{aligned} \angle PHD &= 180^\circ - 64^\circ \\ &= 116^\circ \end{aligned}$$

$$\begin{aligned} \text{a) } \angle x &= (180^\circ - 116^\circ) \div 2 \\ &= 32^\circ \end{aligned}$$

$$\begin{aligned} \text{b) } \angle GBC &= (180^\circ - 64^\circ) \div 2 \\ &= 58^\circ \end{aligned}$$

$$\begin{aligned} \angle y &= 180^\circ - 58^\circ \\ &= 122^\circ \end{aligned}$$

(Henry Park P5 SA2 2014)

Ans : a) 32°
b) 122°

GUIDED EXAMPLE 5

In the figure below, not drawn to scale,
 ABC is an equilateral triangle and ACG is an isosceles triangle.

** mark out equal lengths*

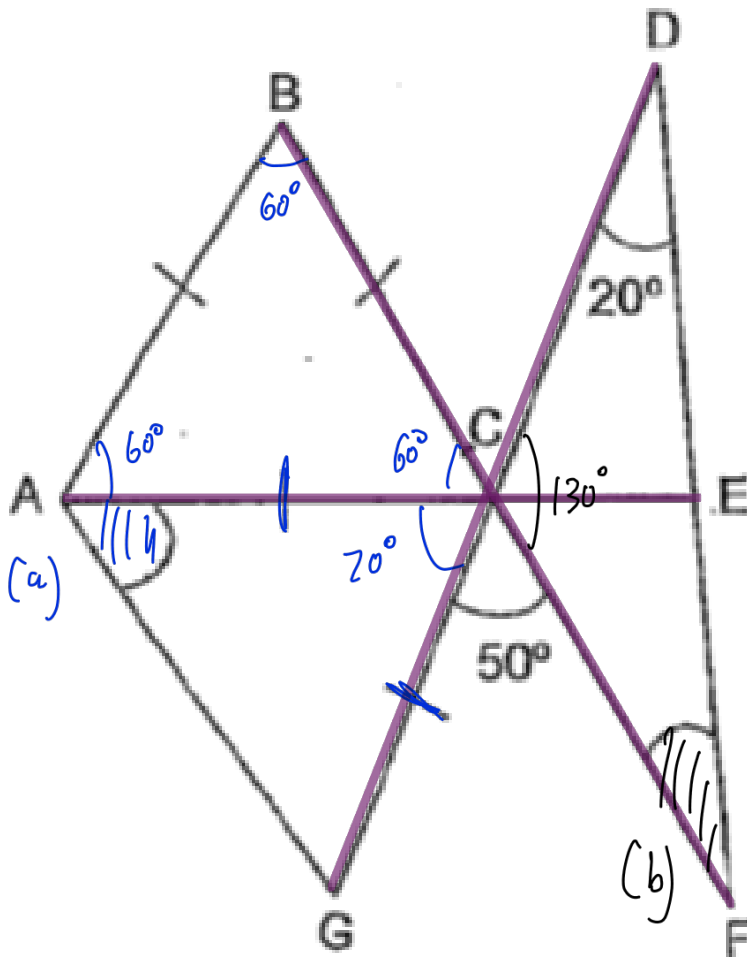
[BCF, DCG and ACE are straight lines.]

$\angle CDF = 20^\circ$ and $\angle FCG = 50^\circ$.

a) Find $\angle CAG$

b) Find $\angle CFE$

(ACS P5 SA2)



$$\begin{aligned} \text{a) } \angle ACG &= 180^\circ - 60^\circ - 50^\circ \\ &= 70^\circ \\ \angle CAG &= (180^\circ - 70^\circ) \div 2 \\ &= 55^\circ \end{aligned}$$

$$\begin{aligned} \text{b) } \angle DCF &= 60^\circ + 70^\circ \\ &= 130^\circ \\ \angle CFE &= 180^\circ - 130^\circ - 20^\circ \\ &= 30^\circ \end{aligned}$$

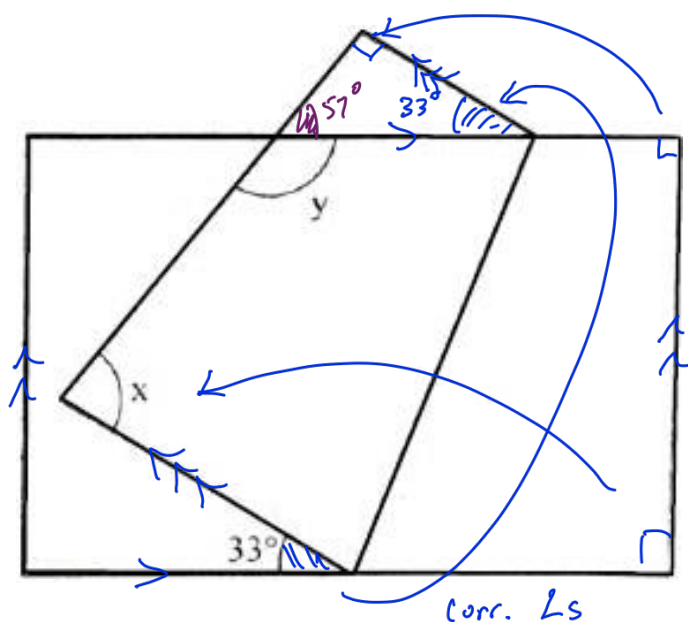
Ans : a) 55°
 b) 30°

BUILD YOUR UNDERSTANDING

1. A rectangular piece of paper is folded as shown below.
Find

- a) $\angle x$
- b) $\angle y$

(Henry Park Pri/P6 Prelim/Q44)



a) $\angle x = 90^\circ$

b) $180^\circ - 90^\circ - 33^\circ = 57^\circ$

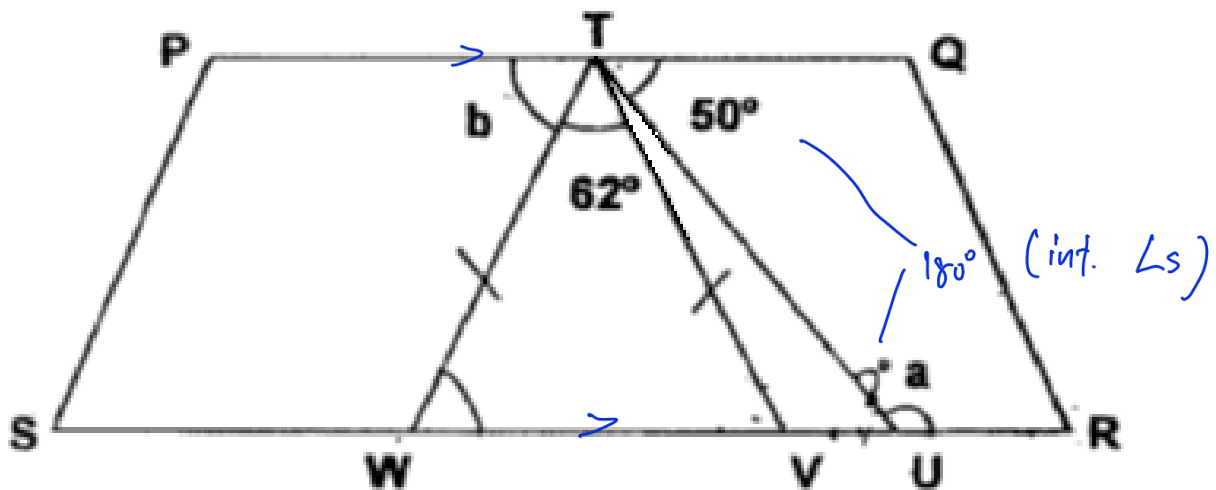
$\angle y = 180^\circ - 57^\circ$
 $= 123^\circ$

Ans : a) 90°

b) 123°

2. In the figure below, not drawn to scale, PQRS is a trapezium and TVW is an isosceles triangle.

- a) Find $\angle a$.
- b) Find $\angle b$.



(Tao Nan P5 SA2)

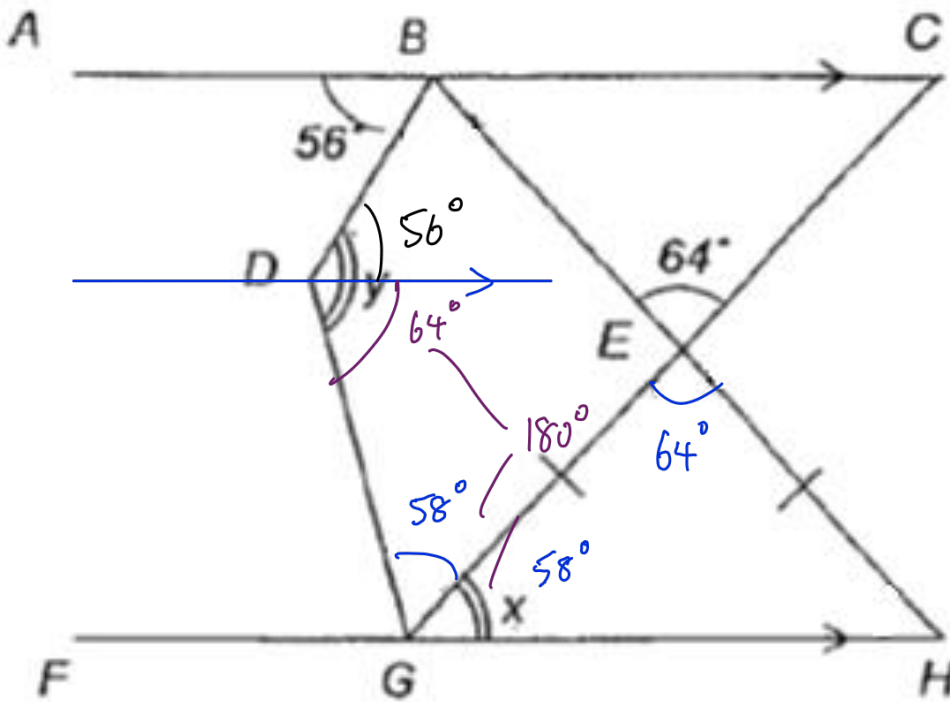
$$\begin{aligned} \text{a) } \angle a &= 180^\circ - 50^\circ \\ &= 130^\circ \end{aligned}$$

$$\begin{aligned} \text{b) } \angle b &= \angle TWV \text{ (alt. } \angle\text{s)} \\ &= (180^\circ - 62^\circ) \div 2 \\ &= 59^\circ \end{aligned}$$

Ans : a) 130°
 b) 59°

3. In the figure below, line AC is parallel to line FH.
 Line GC cuts $\angle DGH$ into half. *BH is a straight line.*
 Given that $\angle ABD = 56^\circ$ and $\angle BEC = 64^\circ$, find:

- a) the value of $\angle x$ and
 b) the value of $\angle y$



(SCGS P5 SA2)

$$\begin{aligned} \text{a) } \angle x &= (180^\circ - 64^\circ) \div 2 \\ &= 58^\circ \end{aligned}$$

$$\begin{aligned} \text{b) } \angle DGE &= \angle x \\ &= 58^\circ \end{aligned}$$

$$180^\circ - 58^\circ - 58^\circ = 64^\circ$$

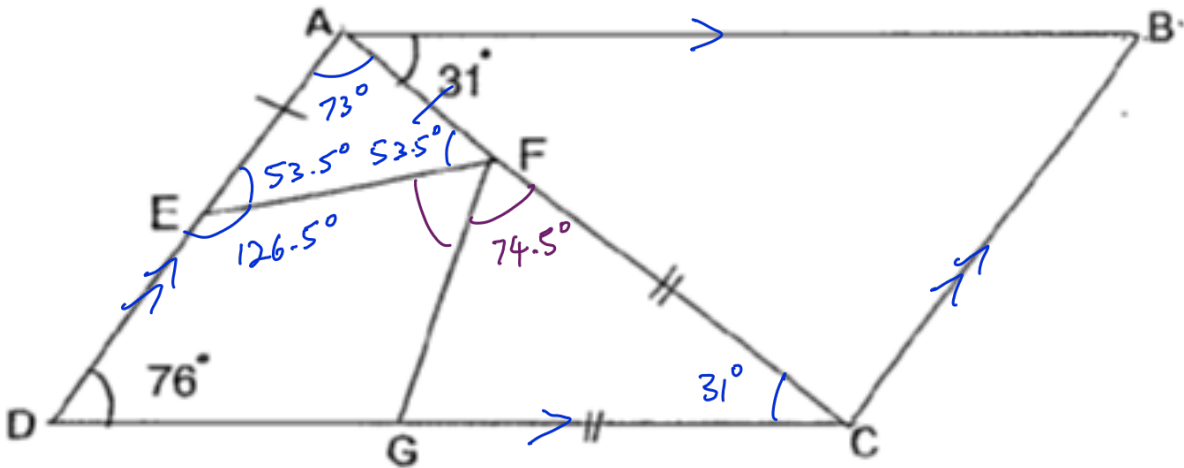
$$\begin{aligned} \angle y &= 56^\circ + 64^\circ \\ &= 120^\circ \end{aligned}$$

Ans : a) 58°

b) 120°

4. The figure below is not drawn to scale.
 ABCD is a parallelogram.
 AFC is a straight line.
 AF = AE and CF = CG.
 $\angle ADG = 76^\circ$ and $\angle BAC = 31^\circ$.

- a) Find $\angle DEF$.
 b) Find $\angle EFG$.



(Nanyang P5 SA2)

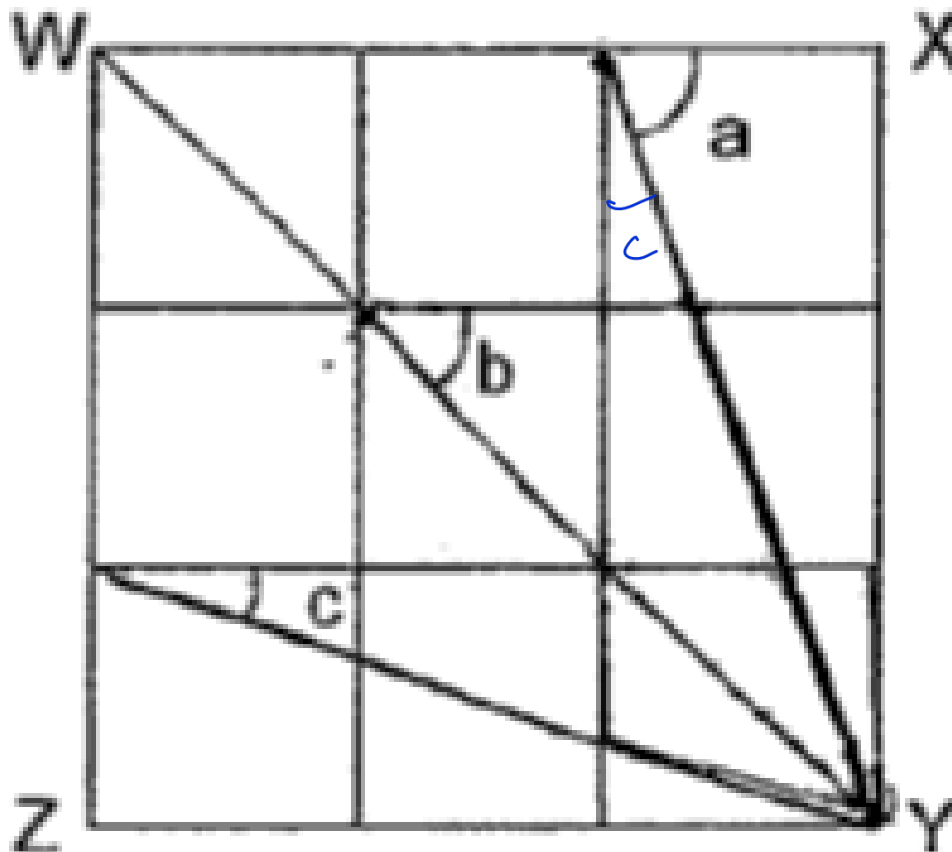
$$\begin{aligned} \text{a) } \angle DAF &= 180^\circ - 76^\circ - 31^\circ \\ &= 73^\circ \\ \angle AEF &= (180^\circ - 73^\circ) \div 2 \\ &= 53.5^\circ \\ \angle DEF &= 180^\circ - 53.5^\circ \\ &= 126.5^\circ \end{aligned}$$

$$\begin{aligned} \text{b) } \angle GFC &= (180^\circ - 31^\circ) \div 2 \\ &= 74.5^\circ \end{aligned}$$

$$\begin{aligned} \angle EFG &= 180^\circ - 53.5^\circ - 74.5^\circ \\ &= 52^\circ \end{aligned}$$

Ans : a) 126.5°
 b) 52°

5. In the figure below, WXYZ is a square which is made up of 9 identical squares. Find the sum of $\angle a$, $\angle b$ and $\angle c$.



* use grouping

(Henry Park P5 SA2)

$$\angle a + \angle c = 90^\circ$$

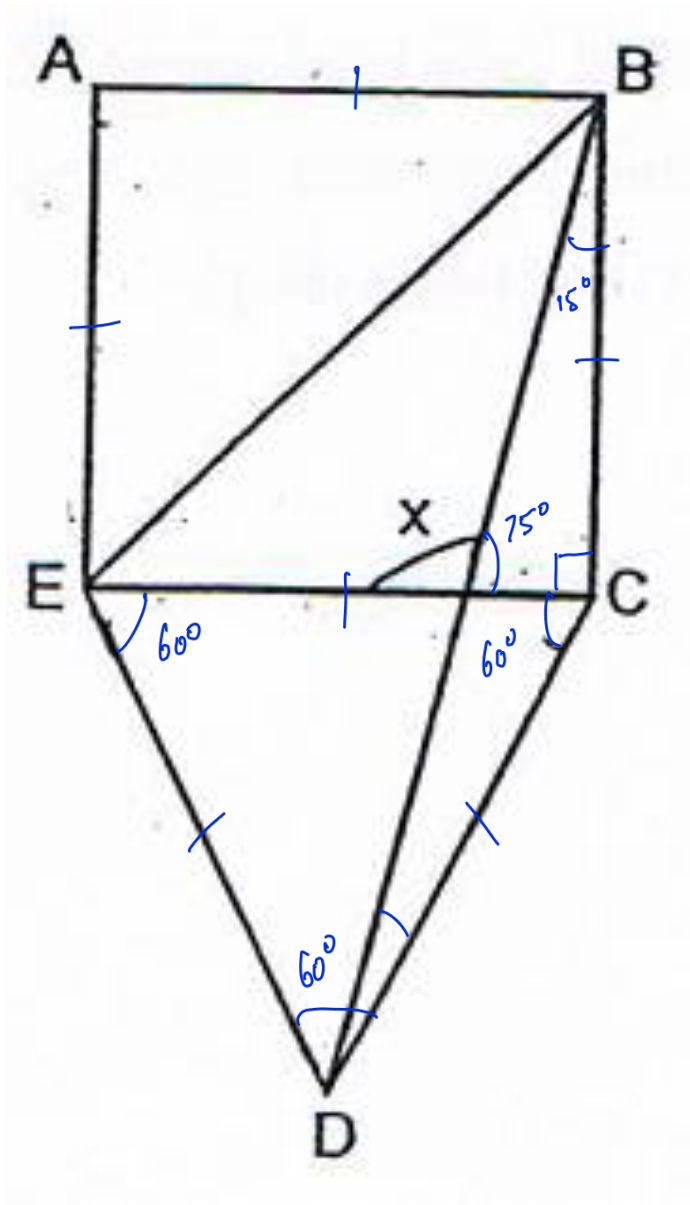
$$\angle b = 45^\circ$$

$$\begin{aligned} \text{Required sum} &= 90^\circ + 45^\circ \\ &= 135^\circ \end{aligned}$$

$$\text{Ans: } \underline{135^\circ}$$

6. In the figure below, not drawn to scale, ABCE is a square and EDC is an equilateral triangle. Find $\angle x$.

(ACS P5 SA2 Paper 2 Q16)



* mark out equal lengths

Observe that $BC = CD$

$\therefore \triangle BCD$ is isosceles.

$$\angle DBC = (180^\circ - 90^\circ - 60^\circ) \div 2 = 15^\circ$$

$$180^\circ - 15^\circ - 90^\circ = 75^\circ$$

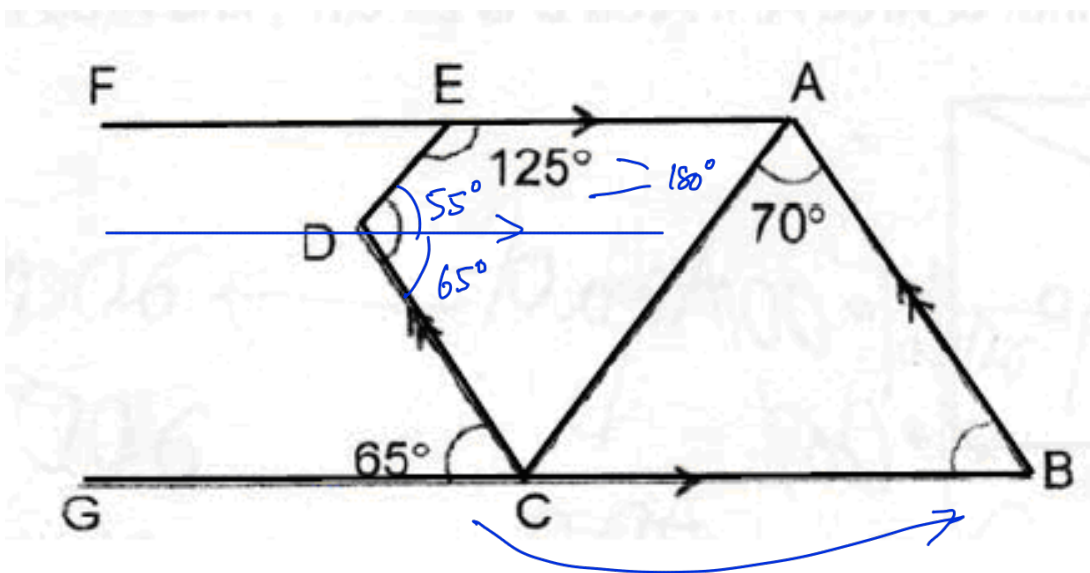
$$\angle x = 180^\circ - 75^\circ = 105^\circ$$

Ans : 105°

7. In the figure below (not drawn to scale), $AF \parallel BG$ and $CD \parallel AB$.
Find

- (a) $\angle ABC$
- (b) $\angle EDC$

(Christian Brothers' School/P6 Prelim/Q41)



$$\begin{aligned} \text{a) } \angle ABC &= \angle GCD \quad (\text{corr. } \angle\text{s}) \\ &= 65^\circ \end{aligned}$$

$$\text{b) } 180^\circ - 125^\circ = 55^\circ$$

$$\begin{aligned} \angle EDC &= 55^\circ + 65^\circ \\ &= 120^\circ \end{aligned}$$

$$\begin{aligned} \text{Ans: } \text{a) } & \underline{65^\circ} \\ \text{b) } & \underline{120^\circ} \end{aligned}$$